University of Colombo, Sri Lanka

University of Colombo School of Computing

DEGREE OF BACHELOR OF INFORMATION TECHNOLOGY (EXTERNAL)

Academic Year 2024— 1^{st} Year Examination — Semester 2

IT2106 — Mathematics for Computing I

Multiple Choice Question Paper

(2 Hours)

Important Instructions

- The duration of the paper is **2 Hours**.
- The medium of instructions and questions is English.
- This paper has **40 questions** on **08 pages**. Answer **all** questions.
- All questions are of the **MCQ** (Multiple Choice Questions) type.
- Each question will have **5 (five)** choices with **ONE OR MORE** correct answers.
- This paper consists of 100 marks and all the questions will carry equal marks.
- There will be a penalty for incorrect responses to discourage guessing.
- The mark given for a question will vary from -1 (All the incorrect choices are marked & no correct choices are marked) to +1 (All the correct choices are marked & no incorrect choices are marked). However, **the minimum mark per question would be zero**.
- Answers should be marked on the **special answer sheet** provided.
- Note that questions appear on both sides of the paper. If a page or part of a page is not printed, please inform the supervisor/invigilator immediately.
- Mark the correct choices on the question paper first and then transfer them to the given answer sheet which will be machine marked. **Please completely read and follow the instructions given on the other side of the answer sheet before you shade your correct choices.**
- Any electronic device capable of storing and retrieving text, including electronic dictionaries, smartwatches, and mobile phones, is not allowed.
- Calculators are **not** allowed.
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1) Which of the following statements is (are) not true?

(a) $\log_{10} 10 = 1$
(b) $\log_{10} 1 = 0$
(c) $\log_{10}(1+2+3) = \log_{10} 1 + \log_{10} 2 + \log_{10} 3$
(d) $\log_{10}(2+3) = \log_{10}(2 \times 3)$
(e) $\log_{10}(2 \times 3) = \log_{10} 2 + \log_{10} 3$.

2) The value of the expression given below is equal to

$$\frac{1}{\log_2 120} + \frac{1}{\log_3 120} + \frac{1}{\log_4 120} + \frac{1}{\log_5 120}$$

(a) 0 (b) 1 (c) 30
(d) 60 (e) 120.

3) Which the following sentences is (are) not a proposition:

(a) What time is it? (b) 4 is an odd integer. (c) Answer this question.
(d) $4 + 2x = 3$. (e) $2 + 3 = 8$.

4) Let p and q be two propositions. Which of the following is a **contradiction?**

(a) $(p \vee q) \rightarrow q$ (b) $(p \wedge q) \wedge (\neg p \vee \neg q)$ (c) $p \vee (q \rightarrow p)$
(d) $(p \vee q) \rightarrow (p \wedge q)$ (e) $(p \wedge q) \rightarrow (p \vee q)$.

5) If $x = 3 + 2\sqrt{3}$, then the value of $\left(\sqrt{x} - \frac{1}{\sqrt{x}}\right)$ is

(a) 1 (b) $\sqrt{3}$ (c) $2\sqrt{3}$
(d) 2 (e) $3\sqrt{3}$.

6) The value of the arithmetic expression $(256)^{0.16} \times (256)^{0.09}$ is equal to

(a) 0 (b) 1 (c) 4
(d) 8 (e) 16.

7) Let p be the statement "Nimal is rich" and q be the statement "Nimal is happy". Then, the symbolic form of the compound statement "Nimal is poor but happy" is

(a) $\neg(p \wedge q)$ (b) $\neg p \vee q$
(c) $\neg p \wedge q$ (d) $p \wedge \neg q$
(e) $\neg p \rightarrow q$.

8) Which of the following biconditional statements is (are) true?

(a) $2 + 2 = 4$ if and only if $4 + 2 = 6$.	
(b) $2 + 2 = 4$ if and only if $4 + 2 = 7$.	
(c) $2 + 2 = 5$ if and only if $4 + 2 = 6$.	
(d) $2 + 2 = 5$ if and only if $4 + 2 = 7$.	
(e) x and y are odd integers if and only if $x + y$ is odd.	

9) If $A = \{1, 2, 3, 4\}$, and $B = \{3, 4, 5\}$, then $A - B$ and $A\Delta B$ are respectively equal to

(a) $\{5\}$ and $\{1, 2, 5\}$	(b) $\{1, 2\}$ and $\{1, 2, 5\}$	(c) $\{1, 2\}$ and $\{1, 2, 3, 4, 5\}$
(d) $\{1, 2, 5\}$ and $\{1, 2\}$	(e) $\{1, 2\}$ and $\{1, 5\}$.	

10) Let $F(x)$ be the predicate (propositional function) " x is my friend" and let $P(x)$ be the predicate "x is perfect". Then the statement "None of my friends are perfect" can be symbolically written as

(a) $\forall x\, (F(x) \to \neg P(x))$	(b) $\forall x\, (F(x) \wedge \neg P(x))$	(c) $\neg\, \exists x\, (F(x) \wedge P(x))$
(d) $\exists x\, (F(x) \to \neg P(x))$	(e) $\exists x\, \neg(F(x) \wedge P(x))$.	

11) Let $\Omega = \{k : k\ is\ a\ natural\ number\ such\ that\ 1 \leq k \leq 150\}$, $A = \{x \in \Omega: x\ is\ a\ multiple\ of\ 6\}$, and $B = \{x \in \Omega: x\ is\ a\ multiple\ of\ 10\}$. Then the total number of elements in AUB is equal to

(a) 40	(b) 25	(c) 30
(d) 35	(e) 45.	

12) Let φ denote the empty set. Which of the following statements is (are) true about the sets:

(a) $\varphi \in \{0\}$	(b) $\varphi \in \{\varphi\}$	(c) $\{\varphi\} \in \{\varphi\}$
(d) $\{\varphi\} \subseteq \{\varphi, \{\varphi\}\}$	(e) $0 \in \varphi$.	

13) Let p and q be two propositions. The converse and contrapositive of the conditional statement $p \to q$ are respectively equal to

(a) $q \to p$ and $\neg p \to \neg q$	(b) $q \to p$ and $\neg q \to \neg p$	(c) $\neg q \to \neg p$ and $\neg p \to \neg q$
(d) $\neg p \to \neg q$ and $\neg q \to \neg p$	(e) $\neg q \to \neg p$ and $q \to p$.	

14) Let f and g be two functions defined on the set of all integers ($\mathbb{Z}$) respectively by $f(x) = 2x$ and $g(x) = 3x + 1$. Then $(f \circ g)(2)$ is equal to

(a) 13	(b) 16	(c) 7
(d) 5	(e) 14.	

15) Let $A = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$. Then the number of subsets of A containing exactly three elements is equal to

(a) 120	(b) 45	(c) 90
(d) 80	(e) 30.	

16) Let A and B be two subsets of a set U. Which of the following statements is (are) true?

(a) $A \cup (B - A) = A \cup B$	(b) $A = (A \cup B) \cup (A - B)$	(c) $B = (A \cup B) - (A - B)$
(d) $A - B = A - (A \cap B)$	(e) $A = (A - B) \cup (B - A)$.	

17) Let A and B be two non-empty finite sets containing m and n number of elements respectively. Then the total number of non-empty relations that can be defined from A to B is equal to

(a) $mn - 1$	(b) m^n	(c) $m^n - 1$
(d) 2^{mn}	(e) $2^{mn} - 1$.	

18) Let $f: \mathbb{R} \longrightarrow \mathbb{R}$ be a function defined by $f(x) = ax + b$, where a and b are integers and $\mathbb{R}$ is the set of all real numbers. If $f(-1) = -5$ and $f(3) = 3$, then a and b are respectively equal to

(a) 2 and -3	(b) -3 and -1	(c) 2 and 3
(d) 0 and 2	(e) -1 and 3.	

19) Let $P(x)$ be a predicate defined on $D = \{x_1, x_2, \cdots, x_{10}\}$. If $\exists x\, P(x)$ is **false**, which of the following is (are) true?

(a) $\neg P(x_7)$	(b) $\neg \exists x\, P(x)$	(c) $\forall x\, P(x)$
(d) $\neg \exists x \neg P(x)$	(e) $\forall x \neg P(x)$.	

20) Let R be a binary relation on the set of all positive integers ($\mathbb{Z}^+$) defined by $(n, m) \in R$ if and only if $2n + 3m = 20$. How many elements are there in R?

(a) 1	(b) 2	(c) 3
(d) 4	(e) 5.	

21) If set A contains four elements and set B contains five elements, then the number of one-to-one and onto mappings from A to B is

(a) 120	(b) 24	(c) 64
(d) 0	(e) 16.	

22) Let R be a binary relation on the set of all non-zero integers defined by $(n, m) \in R$ if and only if $n \times m > 0$. Which of the following statements is true?

(a) R is an equivalence relation.
(b) R is not an equivalence relation.
(c) R is symmetric but not transitive.
(d) R is reflexive, symmetric but not transitive.
(e) R is symmetric and transitive but not reflexive.

23) Let f be a binary relation from the set $X = \{1, 2, 3\}$ to the set $Y = \{a, b, c, d\}$. Which of the following relations f defines a function from X to Y?

(a) $f = \{(1, a), (2, b), (2, c), (3, c)\}$
(b) $f = \{(1, a), (2, c), (3, c)\}$
(c) $f = \{(1, a), (2, b)\}$
(d) $f = \{(1, a), (2, b), (2, c), (3, d)\}$
(e) $f = \{(1, a), (2, a), (2, a), (3, a)\}$.

24) Nimal and Sarath play a tennis match. The first person to win two games wins the match. In how many ways can a winner be determined. (You may assume that there is no way for a game to end in a draw.)

(a) 4	(b) 4	(c) 6
(d) 8	(e) 3.	

25) Find the number of arrangements that can be made by taking all the letters in the word "APPLEPIE"?

(a) 6720	(b) 3360	(c) 13440
(d) 40320	(e) 10080.	

26) Let A and B be two subsets of a set U. Which of the following is (are) correct?

(a) $A - B = \{x : x \in A \wedge x \notin B\}$
(b) $A \triangle B = \{x : x \in (A - B) \wedge x \in (B - A)\}$
(c) $A \triangle B = (A \cup B) - (A \cap B)$
(d) $A \times B = \{x : x \in A \vee x \in B\}$
(e) $A \cap B = \{x : x \in A \wedge x \in B\}$.

27) Let S be set with five elements. How many elements are there in the largest equivalence relation on S?

(a) 25	(b) 32	(c) 10
(d) 64	(e) 16	

28) Let $R = \{ (2,1), (3,1), (3,2), (4,1), (4,2), (4,3)\}$ be a binary relation on the set $\{1, 2, 3, 4\}$. Which of the following statements is (are) true?

(a) R is reflexive.
(b) R is symmetric.
(c) R is anti-symmetric.
(d) R is transitive.
(e) R is reflexive and anti-symmetric.

29) The meaning of the proposition "$\forall x\ \exists y\ P(x, y\}$" in predicate logic is

(a) For every x, there exists y such that $P(x, y)$ is true.
(b) There exists some y such that $P(x, y)$ is true for every x.
(c) For every x, there exists y such that $P(x, y)$ is false.
(d) There exists some y such that $P(x, y)$ is false for every x.
(e) For every y, there exists x such that $P(x, y)$ is true.

30) Let $A = \{1, 2, 3, 4, 5, 6\}$. Suppose that $\wp(A)$ is the set of all subsets of A. Let R be a binary relation defined on $\wp(A)$ by $(P, Q) \in R \iff P \cap Q \neq \varphi$. Then which of the following statements is true.

(a) R is an equivalence relation.
(b) R is reflexive and symmetric.
(c) R is symmetric.
(d) R is transitive and symmetric.
(e) R is reflexive.

31) Out of 7 consonants and 4 vowels, how many strings (words) of 3 consonants and 2 vowels can be formed?

(a) 210	(b) 120	(c) 25200
(d) 21230	(e) 24320.	

32) Which of the following sets of statements is (are) inconsistent?

(a) $p \vee q, \neg p,\ q$
(b) $\neg(q \rightarrow p),\ q,\ p$
(c) $\neg(q \rightarrow p),\ q,\ \neg p$.
(d) $p \wedge q, p \vee q, \neg p$
(e) $p \vee q,\ \neg p,\ p \rightarrow q$.

33) A coach must choose five out of ten players to kick tie-breaking penalty shots. Assuming the coach must designate the order of the five players, determine the number of available different arrangements the coach has.

(a) 252	(b) 3360	(c) 120
(d) 6720	(e) 30240.	

34) Let A, B and C be three mutually exclusive and exhaustive events. Let $P(A), P(B)$, and $P(C)$ be the probabilities of events A, B, and C respectively. If $P(A) = 2P(B) = 6P(C)$, then find $P(B)$.

(a) 0.1
(b) 0.2
(c) 0.3
(d) 0.4
(e) 0.5

35) An unbiased coin is tossed four times. What is the probability of getting heads exactly three times?

(a) $^1/_4$
(b) $^3/_8$
(c) $^3/_{16}$
(d) $^1/_2$
(e) $^3/_4$

36) A box contains 5 black and 5 red balls. Two balls are randomly picked one after another from the box. What is the probability that both balls drawn are red?

(a) $^1/_2$
(b) $^{19}/_{90}$
(c) $^{19}/_{45}$
(d) $^2/_9$
(e) $^7/_9$

37) If A and B are two events such that $P(A)$ = 5/12, $P(B)$ = 2/3, and $P(\bar{A} \cap \bar{B})$ = 1/12, then $P(A \cap \bar{B})$ is equal to

(a) $1/2$
(b) $1/3$
(c) $2/3$
(d) $1/4$
(e) $3/4$.

38) What is the probability that in the random arrangement of the letters of the word "COMMITTEE", the two M's does not come together?

(a) $1/4$	(b) $1/2$	(c) $5/9$
(d) $7/9$	(e) $8/9$	

39) Nimal is known to speak the truth 3 out of 4 times. Nimal throws an unbiased die and reports that it is a two. Find the probability that it is actually a two.

(a) $3/8$	(b) $5/8$	(c) $7/8$
(d) $3/4$	(e) $1/4$	

40) When the occurrence of one event has no effect on the probability of the occurrence of another event, the events are called:

(a) Dependent events	(b) Equally likely events	(c) Exhaustive events
(d) Mutually exclusive events	(e) Independent events.	

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